

THE INTERNATIONAL OCEAN CARBON COORDINATION PROJECT (IOCCP)

A joint project of SCOR and IOC and an affiliate program of the Global Carbon Project.

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Planned at the University of East Anglia, Norwich, England

www.ioccp.org

Community review of guide for “Best Practices in Ocean Acidification Research and Data Reporting” open now until July 15, 2009

The community review of the guide is now open (<http://www.epoca-project.eu/index.php/Home/Guide-to-OA-Research/>). All scientists are invited to provide comments and suggestions on any aspect of the guide to the lead authors of the respective sections and cc the editors (see below). Lead authors may decide to include the names of experts who have provided substantial input to their section to the list of contributing authors.

The recognition and usefulness of this guide critically depends on the level of community consensus it can generate. We therefore urge you to provide input on any part of this document. After completion, the guide will be made available electronically and in printed form via EPOCA, IOC and OCB. It is envisioned to revisit and possibly revise the guide to accommodate new developments in the field in a few years time.

The “Guide to Best Practices in Ocean Acidification Research and Data Reporting” is intended as a reference to provide guidance for research in the rapidly growing field of ocean acidification. Its preparation was initiated by the European Project on Ocean Acidification (EPOCA) and the International Oceanographic Commission (IOC) and sponsored by EPOCA, IOC, the Scientific Council on Oceanic Research (SCOR), the U.S. Ocean Carbon and Biogeochemistry Project (OCB), and the Kiel Excellence Cluster "The Future Ocean". Each section of the guide listed below was seen by independent experts in the field whose comments and suggestions were incorporated.

Chapter 1: Seawater carbonate chemistry

1.1 Carbonate system measurements

1.2 Approaches and tools to manipulate the carbonate chemistry

Chapter 2: Experimental design of perturbation experiments

- 2.1 Atmospheric CO₂ targets for ocean acidification perturbation experiments
- 2.2 Designing ocean acidification experiments to maximize inference
- 2.3 Bioassays, batch culture and chemostat experimentation
- 2.4 Pelagic mesocosms
- 2.5 Laboratory experiments and benthic mesocosm studies
- 2.6 In situ perturbation systems and natural CO₂ venting site

Chapter 3: Measurements of CO₂ sensitive processes

- 3.1 Studies of metabolism and acid-base status
- 3.2 Production and export of organic matter
- 3.3 Pelagic calcification
- 3.4 Benthic calcification

Chapter 4: Data reporting and data usage

- 4.1 Modeling considerations
- 4.2 Safeguarding and sharing ocean acidification knowledge

Ulf Riebesell, Victoria Fabry, Jean-Pierre Gattuso (editors)

For more information: visit the website (<http://www.epoca-project.eu/index.php/Home/Guide-to-OA-Research/>).

Development of a new “US Carbon Cycle Science Plan”

A working group of 27 scientists was formed in 2008 under the United States Carbon Cycle Science Program's Science Steering Group to review the 1999 "A US Carbon Cycle Science Plan" and to develop an updated strategy for research on the global carbon cycle to be conducted by U.S. researchers for the period from 2010 to 2020.

Information about the working group can be found at the USCCSP web site (<http://www.carboncyclescience.gov/carbonplanning.php>).

The USGCRP/CCSP Strategic Planning Building Block on the global carbon cycle summarizing the current status of the science plan can be found at:
<http://www.carboncyclescience.gov/documents/Carbon-Cycle-Scoping-Paper-27Mar09.pdf>

The 1999 US Carbon Cycle Science Plan helped lead to the creation of the OCB and the North American Carbon Program. The NACP investigators are actively debating the directions and priorities for carbon cycle research over the next decade and it is important get the ocean community more involved in these discussions. Based on the community input, three overarching questions have been identified that should be addressed in the coming decade:

- 1) How do natural processes and human actions affect the carbon cycle, on

land, in the atmosphere, and in the oceans?

2) How do policy and management decisions affect the levels of atmospheric carbon dioxide and methane?

3) How are ecosystems, species, and resources impacted by increasing greenhouse gas concentrations, the associated changes in climate, and carbon management decisions?

The first question encompasses the primary focus of the 1999 science questions, with an enlarged emphasis on human processes and added emphasis on understanding the role of methane, the second most important carbon based greenhouse gas, in the global carbon cycle. The second and third questions address the new priorities identified by the current working group. We invite you to read and comment on the building blocks document at: <http://carboncyclescience.blogspot.com/>

The ocean carbon community is asked for input regarding the development of a new “US Carbon Cycle Science Plan” that is currently underway. It is time for the Science Plan Working Group to begin fleshing out the full details of the plan, and your input is needed to help us ensure that the ocean carbon cycle receives appropriate attention in the listed priorities. In addition to your comments on the three key questions below, your thoughts on the recent scoping document (<http://www.carboncyclescience.gov/documents/Carbon-Cycle-Scoping-Paper-27Mar09.pdf>) are also welcome.

(1) Based on the three overarching questions identified for the new plan, what are the priorities for ocean carbon research in the next decade?

(2) The new overarching questions place a much stronger emphasis on human dimensions. How will/should this affect the ocean carbon community and how we conduct our science?

(3) What is an appropriate balance between basic carbon cycle research and research aimed at providing information for policy and decision support?

Please send your thoughts to Heather Benway (hbenway@whoi.edu). She will collate all of your responses for discussion at the OCB summer workshop in July.

The ocean members of the Carbon Cycle Science Plan Working Group:
Bob Anderson, Debbie Bronk, Steve Lobrenz, Galen McKinley, Chris Sabine (chair)

For more information: Contact Heather Benway (hbenway@whoi.edu) or visit <http://www.carboncyclescience.gov/carbonplanning.php>

Ocean Carbon Community White Papers at OceanObs 09

Almost a decade has passed since the OceanObs'99 symposium played a major role in consolidating the plans for a comprehensive ocean observing system able to deliver systematic global information about the physical environment of the oceans. It is now critically important to ensure sustainability and further development of the present system and to realize the full extent of the benefits across all stakeholders and for all participating nations. It is equally important to define a clear plan for extending the present system to include comprehensive observation, analysis and forecasting of the biogeochemical state of the ocean and the status of marine ecosystems. The OceanObs'09 symposium will celebrate a decade of progress and make a major contribution to chart the way forward for the coming decade.

A major part of the conference is the development of Community White Papers (CWPs) that document strategies on ocean observations developed by the research community. Ocean carbon figures prominently in several of these. Draft CWPs are now on-line for an open community review process and cross referencing among CWPs until 1 September. The community is encouraged to visit the OceanObs09 symposium site and to review these documents to reach community consensus on priorities for the way forward in the next decade. Specifically, the IOCCP community should take note of the following CWPs:

- Ship-based Repeat Hydrography: A strategy for a sustained global program
- A global sea surface carbon observing system: assessment of sea surface CO₂ and air-sea CO₂ fluxes
- Ocean Acidification Observational Network
- OceanSITES
- Multidisciplinary observation of the surface ocean and lower atmosphere from ship transects
- Automated underway oceanic and atmospheric measurements from ships
- The Ship of Opportunity Programme
- Sensors and systems for observations of marine CO₂ system variables
- Adding oxygen to Argo: An Opportunity to develop a global in-situ observatory for ocean productivity and biogeochemistry in a changing climate
- Observational needs of Dynamic Green Ocean models
- The Southern Ocean Observing System: Progress and plans for sustained observations in the Southern Ocean

For more information: Visit the conference website (www.oceanobs09.net). To review the CWPs, go to <http://www.oceanobs09.net/blog/>

The Surface Ocean CO₂ Atlas (SOCAT) Project Update

The SOCAT dataset now contains over 2,100 cruises from 1968-2007. Benjamin Pfeil and Steve Hankin have agreed that the best way to access the dataset is to keep each cruise as an individual file and to use the LAS system to serve all the data. The regional groups will use LAS to download data, based on definitions of regional boundaries.

Regional groups were tasked with identifying missing datasets from SOCAT version 1.1. The identified regional groups and chairs are:

- Atlantic and Arctic Ocean – Schuster, Lefèvre
- Indian Ocean – VVSS Sarma
- Pacific Ocean – Feely, Nojiri
- Southern Ocean – Tilbrook, Metzl
- Coastal seas – Borges, Chen.
- Global group – Bakker, Olsen, Sabine, Pfeil, Metzl

SOCAT QC-II Definitions of Regional Boundaries as of June, 2009

1. **Tropical Pacific** -- Between 30°S, 30°N, North America and Asia. The boundary between the Indian and the Pacific is Malaysia, Sumatra, Java, and Timor and a line at 130°E to Australia through the Timor Sea.
2. **North Pacific** -- North of 30°N and between North America and Asia, including cruises that go north of Alaska into the Arctic Ocean.
3. **Southern Ocean** -- Everything south of 30°S
4. **Indian Ocean** -- North of 30°S, bounded on the east by the line described above, and on the west by Africa and the Suez Canal.
5. **Atlantic Ocean** -- North of 30°S including the Mediterranean, Black Sea, Barents Sea, and Labrador Sea.
6. **Coastal (a.k.a. "continental margins")** -- All ocean surface within 400 km of land* excluding the Southern Ocean Region.

* The intent of the various working groups was to exclude the margins around small, isolated islands, so the Distance-To-Land variable is calculated from a 20-minute resolution land mask that was altered (through guidance from Burke Hales) to eliminate such islands. The altered land mask retains New Zealand, Iceland, and Madagascar as 'land' and Caribbean islands that show up at the 20 minute resolution, as well as other islands like Tasmania, Sri Lanka, Japan, etc. The following islands were explicitly masked out: Reunion/Mauritius, New Caledonia, Vanuatu, Solomon Islands, Manus Island (N of New Guinea), Galapagos, Smith Island (Indian Ocean; Bay of Bengal), Hawaii, Azores, South Georgia, Macquarie (south of NZ), French Southern and Antarctic Lands.

The various regional groups have started meeting to evaluate the initial data quality, learn to use the LAS tools for conducting 2nd level quality control, and determine a course of action for performing the 2nd level QC checks. The Coastal group meeting was held in Kiel in January 2009 with financial support assembled by the SOLAS International Project Office from various sources including the European COST Action 735. The Pacific regional group met in March 2009 at the Tsukuba, Japan funded by the National Institute for Environmental Studies Institute and SCOR. The Atlantic, Indian, and Southern Ocean regional groups will meet in June at the University of East Anglia supported by COST (SOLAS) and SCOR (IOCCP and IMBER).

(1) SOCAT Coastal Region Meeting Held at IFM-GEOMAR, Kiel, Germany

The SOCAT Coastal Regional Group met at IFM-GEOMAR in Kiel from 22-23 January during a joint workshop with the COST action 735 Working Group 3. The workshop brought together twenty-one scientists from eleven countries and was co-chaired by Alberto Borges and Arthur Chen. The group focused on how to integrate coastal carbon data into the SOCAT database, including 2nd level quality control, and agreed to develop a coastal climatology of fCO₂ and air-sea CO₂ fluxes. Specific discussions focused on:

- Defining the coastal zone as marine waters within 400 km of a continental margin or major island;
- Identification of areas of interest which PIs will lead the 2nd level quality control (QC);
- Mechanisms for achieving 2nd level QC (in particular handling high spatial and temporal variability of fCO₂ in coastal waters);
- Gridding procedures (spatial extent of the coastal zone, grid resolution for binning the fCO₂ data, interpolation);
- Discussing the pros, cons and mechanisms for collapsing the data into a single virtual year taking into account the change in atmospheric CO₂ and inter-annual variability; and
- Best practices for computation of air-sea CO₂ fluxes (atmospheric CO₂, gas transfer velocity parameterization and wind speed data source).

(2) SOCAT Pacific Meeting Held at the National Institute for Environmental Studies, Tsukuba, Japan

The SOCAT Pacific Regional Group met at the National Institute for Environmental Studies in Tsukuba, Japan from 18-20 March 2009. The workshop was co-chaired by Yukihiro Nojiri and Steve Hankin and attended by twenty scientists from seven different countries.

The first day included a review of SOCAT II, status and overview of the SOCAT data set, and an overview of LAS. This was followed by presentations of Pacific data in SOCAT by Alex Kozyr, Chihiro Myazaki, M. Goto, Tsuneo Ono, Masao Ishii, Gen Hashida, Sophie Johanessen, Bronte Tilbrook, Don Jing Kang, and Cathy Cosca.

The final two days of the meeting were spent on practical exercises with cruise data and 2nd level quality control, including downloading the data files, provisional flagging, and identification of possible crossovers. Specifically, breakout groups were given assignments to run 2nd level quality control on different cruises so that not everyone was using the same files at the same time. They found duplicate cruises and flagged data in the data set.

Suggestions were solicited from the group on ways to improve the LAS system and the underlying database. Among the most important agreements was the consensus realization that level 1 QC issues remained to be corrected in the database. Benjamin agreed to issue a new version of the collection (v1.3) that would address the level 1 QC problems identified at the Tsukuba meeting. Steve and Jeremy agreed to add capabilities in the LAS system to facilitate a community process on rooting out level 1 QC problems, as well. Many of the suggestions were of a technical nature regarding enhancements to LAS. Steve and Benjamin agree to prioritize this list and complete as much of it as possible in time for the next (Norwich) meeting. The list will be reviewed and refined again at the Norwich meeting.

A complete meeting report will be available on the IOCCP website (www.ioccp.org) in July 2009.

(3) SOCAT Atlantic, Indian, and Southern Ocean Regional Groups Meeting Planned

The SOCAT Atlantic, Indian, and Southern Ocean Regional Groups meeting will be held at the University of East Anglia, Norwich, UK from 25-26 June 2009 supported by COST (SOLAS) and SCOR (IOCCP and IMBER). The workshop will bring together 30 scientists from 8 different countries to integrate Atlantic, Indian, and Southern Ocean carbon data into the SOCAT database, including 2nd level quality control, and begin development of regional climatologies of fCO₂ and air-sea CO₂ fluxes.

For more information: Contact Kathy Tedesco (k.tedesco@unesco.org) or visit the IOCCP website at www.ioccp.org > SOCAT